Amendments to the Claims

This listing of claims will replace all prior versions, and listings of claims in the application.

1. (Canceled)

2. (Previously Presented) The method of claim 3, further comprising the step of:

(4) varying said phase shift of said pulses of said control signal, and thereby changing said phase shift of said frequency translated signal.

3. (Previously Presented) A method of frequency translating and phase shifting an electromagnetic signal, the method comprising the steps of:

(1) receiving an electromagnetic signal;

(2) generating a control signal having a plurality of pulses that are phase-shifted relative to a reference phase; and

(3) sampling the electromagnetic signal according to said control signal, resulting in a frequency translated electromagnetic signal that is phase shifted according to said phase shift of said pulses of said control signal;

wherein said plurality of pulses have pulse widths;

wherein step (2) comprises the steps of

(a) receiving a local oscillator signal;

(b) leveling shifting said local oscillator signal with a bias voltage, resulting in a biased local oscillator signal; and

(c) generating a pulse when said biased local oscillator signal exceeds a threshold, whereby said reference phase corresponds to a reference bias voltage, and

thereby said phase shift of said pulses of said control signal is determined by a difference between said bias voltage and said reference bias voltage.

4. (Previously Presented) The method of claim 3, further comprising the step of:

(4) varying said bias voltage, and thereby varying said phase shift of said pulses in said control signal relative to said reference phase, and thereby varying said phase shift of said frequency translated electromagnetic signal.

5. (Previously Presented) A method of frequency translating and phase shifting an electromagnetic signal, the method comprising the steps of:

(1) receiving an electromagnetic signal;

(2) generating a control signal having a plurality of pulses that are phase-shifted relative to a reference phase; and

(3) sampling the electromagnetic signal according to said control signal, resulting in a frequency translated electromagnetic signal that is phase shifted according to said phase shift of said pulses of said control signal;

wherein said plurality of pulses have pulse widths;

wherein step (2) comprises the steps of:

(a) receiving a local oscillator signal;

(b) delaying said local oscillator signal according to a delay, resulting in a delayed local oscillator signal; and

(c) generating a pulse when said delayed local oscillator signal exceeds a threshold, whereby said reference phase corresponds to a reference delay, and

thereby said phase shift of said pulses of said control signal is determined by a difference between said delay and said reference delay.

6. (Previously Presented) The method of claim 5, further comprising the step of:

(4) varying said delay, and thereby varying said phase shift of said control signal relative to said reference phase, and thereby varying said phase shift of said frequency translated electromagnetic signal.

7. (Currently Amended) A method of frequency translating and phase shifting an electromagnetic signal, the method comprising the steps of:

(1) receiving an electromagnetic signal;

(2) generating a control signal having a plurality of pulses that are phase-shifted relative to a reference phase; and

(3) sampling the electromagnetic signal according to said control signal, resulting in a frequency translated electromagnetic signal that is phase shifted according to said phase shift of said pulses of said control signal;

wherein said plurality of pulses have pulse widths;

wherein step (2) comprises the steps of

(a) receiving a local oscillator signal having a first signal envelope ~~shape~~;

(b) changing said first signal envelope ~~shape~~ of said local oscillator signal to a second signal envelope ~~shape~~ without changing a phase of said local oscillator signal, resulting in a shaped local oscillator signal; and

(c) generating a pulse when said shaped local oscillator signal exceeds a threshold, whereby said reference phase corresponds to a reference signal envelope ~~shape~~, and thereby said phase shift of said control signal is determined by a difference between said shaped local oscillator signal and said reference signal envelope ~~shape~~.

8. (Canceled)

9. (canceled)

10. (Previously Presented) A method of down-converting and phase shifting an electromagnetic signal, the method comprising the steps of:

(1) receiving an electromagnetic signal;

(2) generating a control signal having a plurality of pulses that are phase-shifted relative to a reference phase;

(3) sampling the electromagnetic signal according to said control signal, resulting in undersamples that are phase shifted according to said phase shift of said pulses of said control signal; and

(4) integrating successive undersamples, resulting in a down-converted output signal that is phase shifted according to said pulses of said control signal;

wherein said plurality of pulses have pulse widths;

wherein step (2) comprises the steps of:

(a) receiving a local oscillator signal;

(b) leveling shifting said local oscillator signal with a bias voltage, resulting in a biased local oscillator signal; and

(c) generating a pulse of said control signal when said biased local oscillator signal exceeds a threshold, whereby said reference phase of said control signal corresponds to a reference bias voltage, and thereby said phase shift of said pulses in said control signal is determined by a difference between said bias voltage and said reference bias voltage.

11. (previously presented) The method of claim 10, further comprising the step of:

(5) varying said bias voltage, and thereby varying said phase shift of said pulses in said control signal relative to said reference phase, and thereby varying said phase shift of said down-converted output signal.

12. (Previously Presented) The method of claim 10, wherein step (b) of level shifting comprises the step of adding said bias voltage to said local oscillator signal.

13. (Previously Presented) A method of down-converting and phase shifting an electromagnetic signal, the method comprising the steps of:

(1) receiving an electromagnetic signal;

(2) generating a control signal having a plurality of pulses that are phase-shifted relative to a reference phase;

(3) sampling the electromagnetic signal according to said control signal, resulting in undersamples that are phase shifted according to said phase shift of said pulses of said control signal; and

(4) integrating successive undersamples, resulting in a down-converted output signal that is phase shifted according to said pulses of said control signal;

wherein said plurality of pulses have pulse widths;

wherein step (2) comprises the steps of

(a) receiving a local oscillator signal;

(b) delaying said local oscillator signal according to a delay element, resulting in a delayed local oscillator signal; and

(c) generating a pulse when said delayed local oscillator signal exceeds a threshold, whereby said reference phase corresponds to a reference delay, and thereby said phase shift of said pulses of said control signal is determined by a difference between said delay and said reference delay.

14. (Previously Presented) The method of claim 13, further comprising the step of:

(5) varying said delay, and thereby varying said phase shift of pulses of said control signal relative to said reference phase, and thereby varying said phase shift of said down-converted output signal.

15. (Previously Presented) The method of claim 10, further comprising the step of:

(5) amplifying said electromagnetic signal.

16. (Previously Presented) A method of down-converting and phase shifting an electromagnetic signal, the method comprising the steps of:

(1) receiving an electromagnetic signal;

(2) generating a control signal having a plurality of pulses that are phase-shifted relative to a reference phase;

(3) sampling the electromagnetic signal according to said control signal, resulting in undersamples that are phase shifted according to said phase shift of said pulses of said control signal; and

(4) integrating successive undersamples, resulting in a down-converted output signal that is phase shifted according to said pulses of said control signal;

wherein said plurality of pulses have pulse widths;

wherein step (2) comprises the steps of

(a) receiving a local oscillator signal having a first signal shape;

(b) changing said first signal shape of said local oscillator signal, resulting in a shaped local oscillator signal; and

(c) generating a pulse when said shaped local oscillator signal exceeds a threshold, whereby said reference phase corresponds to a reference signal shape, and thereby said phase shift of pulses of said control signal is determined by a difference between said shaped local oscillator signal and said reference signal shape.

17. (canceled)

18. (canceled)

19. (canceled)

20. (canceled)

21. (canceled)

22. (canceled)

23. (canceled)

24. (Canceled)

25. (Previously Presented) The method of claim 27, further comprising the step of:

(4) selecting a desired harmonic from said harmonic images that are generated in step (3).

26. (Previously Presented) The method of claim 25, further comprising the step of:

(5) transmitting said desired harmonic over a communications medium.

27. (Previously Presented) A method of up-converting and phase shifting a baseband signal, the method comprising the steps of:

(1) receiving an electromagnetic signal;

(2) generating a control signal having a plurality of pulses that are phase-shifted relative to a reference phase; and

(3) sampling the electromagnetic signal according to said control signal, resulting in a plurality of harmonic images that are each representative of the baseband signal, and are phase shifted according to said phase shift of said pulses in said control signal;

wherein said control signal has pulse widths;

wherein step (2) comprises the steps of:

(a) receiving a local oscillator signal;

(b) leveling shifting said local oscillator signal with a bias voltage, resulting in a biased local oscillator signal; and

(c) generating a pulse of said control signal when said biased local oscillator signal exceeds a threshold, whereby said reference phase corresponds to a reference bias voltage, and thereby said phase shift of said pulses of said control signal is determined by a difference between said bias voltage and said reference bias voltage.

28. (Previously Presented) A method of up-converting and phase shifting a baseband signal, the method comprising the steps of:

(1) receiving an electromagnetic signal;

(2) generating a control signal having a plurality of pulses that are phase-shifted relative to a reference phase; and

(3) sampling the electromagnetic signal according to said control signal, resulting in a plurality of harmonic images that are each representative of the baseband signal, and are phase shifted according to said phase shift of said pulses in said control signal;

wherein said control signal has pulse widths;

wherein step (2) comprises the steps of:

(a) receiving a local oscillator signal;

(b) delaying said local oscillator signal according to a delay, resulting in a delayed local oscillator signal; and

(c) generating a pulse when said delayed local oscillator signal exceeds a threshold, whereby said reference phase of said control signal corresponds to a reference delay, and thereby said phase shift of said pulses of said control signal is determined by a difference between said delay and said reference delay.

29. (Currently Amended) A method of up-converting and phase shifting a baseband signal, the method comprising the steps of:

(1) receiving an electromagnetic signal;

(2) generating a control signal having a plurality of pulses that are phase-shifted relative to a reference phase; and

(3) sampling the electromagnetic signal according to said control signal, resulting in a plurality of harmonic images that are each representative of the

baseband signal, and are phase shifted according to said phase shift of said pulses in said control signal;

wherein said control signal has pulse widths;

wherein step (2) comprises the steps of:

(a) receiving a local oscillator signal having a first signal envelope ~~shape~~;

(b) changing said first signal envelope ~~shape~~ of said local oscillator signal to a second signal envelope without changing a phase of said local oscillator signal, resulting in a shaped local oscillator signal; and

(c) generating a pulse when said shaped local oscillator signal exceeds a threshold, whereby said reference phase corresponds to a reference signal envelope ~~shape~~, and thereby said phase shift of said pulses of said control signal is determined by a difference between said shaped local oscillator signal and said reference signal envelope shape.

30. (Canceled)

31. (Currently Amended) ~~The system of claim 30,~~ A system for frequency translating an electromagnetic signal to generate a frequency translated output signal that is phase shifted relative to a reference phase, comprising:

a pulse generator that is controlled by a local oscillator signal, wherein said pulse generator triggers and generates a pulse when said local oscillator signal exceeds a threshold;

a switch module controlled by pulses from said pulse generator, wherein said switch module samples said electromagnetic signal according to said pulses, resulting in said frequency translated output signal; and

means for varying a time that said local oscillator signal exceeds said threshold of said pulse generator, and thereby phase shifting said frequency translated output signal;

wherein said pulses have pulse widths; and

wherein said means for varying comprises a means for level shifting said local oscillator signal with a bias voltage.

32. (Currently Amended) ~~The system of claim 30,~~

A system for frequency translating an electromagnetic signal to generate a frequency translated output signal that is phase shifted relative to a reference phase, comprising:

a pulse generator that is controlled by a local oscillator signal, wherein said pulse generator triggers and generates a pulse when said local oscillator signal exceeds a threshold;

a switch module controlled by pulses from said pulse generator, wherein said switch module samples said electromagnetic signal according to said pulses, resulting in said frequency translated output signal; and

means for varying a time that said local oscillator signal exceeds said threshold of said pulse generator, and thereby phase shifting said frequency translated output signal;

wherein said pulses have pulse widths; and

wherein said means for varying comprises a means for delaying said local oscillator signal.

33. (Currently Amended) ~~The system of claim 30,~~ A system for frequency translating an electromagnetic signal to generate a frequency translated output signal that is phase shifted relative to a reference phase, comprising:

a pulse generator that is controlled by a local oscillator signal, wherein said pulse generator triggers and generates a pulse when said local oscillator signal exceeds a threshold;

a switch module controlled by pulses from said pulse generator, wherein said switch module samples said electromagnetic signal according to said pulses, resulting in said frequency translated output signal; and

means for varying a time that said local oscillator signal exceeds said threshold of said pulse generator, and thereby phase shifting said frequency translated output signal;

wherein said pulses have pulse widths; and

wherein said means for varying comprises a means for changing a signal envelope ~~shape~~ of said local oscillator signal without changing a phase of said local oscillator signal.

34. (new) The method of claim 7, wherein said first signal envelope is sinusoidal and said second signal envelope is a square wave.

35. (new) The method of claim 7, wherein said first signal envelope is sinusoidal and said second signal envelope is a saw tooth wave.

36. (new) The method of claim 7, wherein said first signal envelope is a square wave and said second signal envelope is a saw tooth wave.

37. (new) The method of claim 7, wherein said first signal envelope is a square wave and said second signal envelope is sinusoidal.

38. (new) The method of claim 7, wherein said first signal envelope is a saw tooth and said second signal envelope is sinusoidal.

39. (new) The method of claim 7, wherein said first signal envelope is a saw tooth and said second signal envelope is a square wave..

40. (New) A method of frequency translating and phase shifting an electromagnetic signal, the method comprising the steps of:

(1) receiving an electromagnetic signal;

(2) generating a control signal having a plurality of pulses that are phase-shifted relative to a reference phase; and

(3) sampling the electromagnetic signal according to said control signal, resulting in a frequency translated electromagnetic signal that is phase shifted according to said phase shift of said pulses of said control signal;

wherein step (2) comprises the steps of

(a) receiving a local oscillator signal having a sinusoidal signal shape;

(b) changing said sinusoidal signal shape of said local oscillator signal to a square wave shape or a saw tooth shape, resulting in a shaped local oscillator signal; and

(c) generating a pulse of said plurality of pulses when said shaped local oscillator signal exceeds a threshold, whereby said reference phase corresponds to said sinusoidal signal shape and said phase shift of said control signal is determined by a difference between said shaped local oscillator signal and said sinusoidal signal shape.